M. Cornu has shown that the quadruple group of rays in the magnesium spectrum may become quintuple or sextuple, according to the increased intensity of the spark employed. This is precisely what might happen if one reversal by over-exposure were followed by a second. Such reversals might be looked for if under the conditions of the stronger spark the exposure of the plate were not shortened, because the first and third of the four lines are stronger than the other two, and they would therefore be the first and second to suffer reversal. The reversal would split the lines in two, and hence produce the appearance of a sextuple group. In order to ascertain whether this might readily occur in the magnesium spectrum, some observations were made with plates containing several photographs obtained by different periods of exposure. Thus the first spectrum was the result of ten seconds, the second of half a minute, and others various times extending to half an hour. The quadruple group was not affected in the way observed by M. Cornu, from which fact it would appear that the division of the lines was caused by a reversal which was the result of absorption of the central portion of the ray or rays. In the two photographs obtained by the longest exposures, especially in the last, the triplet b' between K and L became a quadruple group by reason of the most refrangible line being split into two by a reversal, the cause of which was nothing more than over-exposure. In the quadruple group previously mentioned the lines were totally reversed or not at all. This subject of reversal by over-exposure is one well deserving the attention of those who are engaged in the study of solar physics. Comparative exposures should be methodically employed to confirm the accuracy of observations made entirely by the aid of photographic representations of spectra. Especially is this desirable when gelatine or other dry plates containing organic matter are in use.

III. "Experiments on the Value of the Ohm." Part I. By R. T. Glazebrook, M.A., Fellow and Assistant Lecturer of Trinity College, Demonstrator at the Cavendish Laboratory, Cambridge, and J. M. Dodds, B.A., Fellow of St. Peter's College. Part II. By R. T. Glazebrook, and E. B. Sargant, M.A., Trinity College. Communicated by Lord Rayleigh, F.R.S. Received May 24, 1882.

(Abstract.)

The method of the experiments is a modification of those of Kirchhoff and Rowland.

Two coils of copper wire of about 25 centims. radius, each containing

about 780 turns, were placed with their mean planes parallel and at a known distance apart. The coefficient of mutual induction between the two can be found from the geometrical data; let this be M. Let one of the coils be connected in circuit with a ballistic galvanometer, and let R be the resistance in centimetres per second of the circuit. Let a steady current of intensity i be circulating in the other coil—the primary. On reversing this current an induction current, of which the amount is $\frac{2Mi}{R}$, is produced in the secondary circuit, and the galvanometer needle is disturbed from rest; if β be the first throw of the needle, T the time of a complete vibration, λ the coefficient of damping, τ that of torsion, G the galvanometer constant, and H the horizontal intensity of the earth's magnetism, we have

$$\frac{2Mi}{R}=\frac{H(1+\tau)}{G}\frac{T}{\pi}\cdot\left(1+\frac{\tau}{2}\right)\left(1+\frac{\lambda}{2}\right)\sin\frac{\beta}{2}.$$

The galvanometer was then connected in series with a large resistance coil, in our case of about 3,000 ohms; let S be the resistance of the galvanometer and this coil. The two extremities of the resistance S were connected with two points in the primary circuit, the resistance between which was about 1 ohm; let this resistance be V. Then of the primary current i, an amount $\frac{V}{S+V}i$, is transmitted through the galvanometer, and if α be the deflection of the needle, we have

$$\frac{V}{S+V}i=\frac{H(1+\tau)}{G}\tan\alpha.$$

Eliminating i, G and H, we obtain

$$R=\frac{2\pi M}{T\left(1+\frac{\tau}{2}\right)\left(1+\frac{\lambda}{2}\right)}\cdot\frac{S+V}{V}\cdot\frac{\tan\alpha}{\sin\frac{\beta}{2}}.$$

And if $\bar{R}$ be the value of R in ohms, the ratio $\frac{R}{\bar{R}}$ gives us the value of the ohm in centimetres per second.

The coils and galvanometer were wound for this purpose with great care by Professor Chrystal under the supervision of the late Professor Clerk Maxwell. Professor Chrystal's removal from Cambridge prevented the completion of the experiments by him.

For a detailed account of the precautions necessary, the methods of making the observations, and the comparison of the resistance coils used, reference must be made to the paper.

Each experiment involves eight observations of throw due to the induction current and two of deflection; the values of the deflection

being obtained from observations of the oscillations of the needle about its position of rest, the chance of error is much smaller than in the throws.

Each set of experiments is the mean of four; one for each of the four positions in which the coils could be placed by inverting first one and then the other without altering the distance between their centres.

Part I, which we regard as preliminary, contains the result of three such sets, and from it we find

$$1 \text{ ohm} = \cdot 98598 \frac{\text{earth quadrant}}{\text{second}}.$$

The mean distance between the mean plane of the coils was 15·019 centims.

In Part II three series of experiments are described for different distances between the mean planes of the coils.

In Series	A	this distance was	15·019	centims.
,,	B	,,	18·252	,,
,,	C	,,	26·692	,,

Different batteries were used.

The following table gives the values of R in earth quadrants/sec. arranged in order of magnitude, with the battery used in each case, the error of each result from the mean, and the percentage error.

In the column headed battery, D stands for an ordinary cylinder Daniell; T for Thomson's sawdust tray Daniell.

Table.

Series.	Battery.	R.	Error.	Percentage error.
B	5 T.	158·106	− ·216	− ·135
A	4 D.	158·168	− ·154	− ·096
A	5 T.	158·231	− ·091	− ·057
C	6 T.	158·238	− ·084	− ·052
B	5 T.	158·303	− ·019	− ·012
C	5 T.	158·332	·010	·006
A	4 D.	158·407	·085	·052
A	2 D.	158·499	·177	·110
C	6 T.	158·611	·289	·181

$$\text{Mean value of R} \quad 158 \cdot 322 \frac{\text{earth quadrant}}{\text{second}}.$$

Mean of errors ·125.

Mean of percentage errors ·078.

The value of R in terms of the ohm was found to be

$$160{\cdot}520\,;$$

the temperature being 12°, the values in the above table have been reduced to this temperature.

From this we find as the value of the ohm—

Series A	·98633	$\frac{\text{earth quadrant}}{\text{second}}$,	4	sets.
,, B	·98558	,,	, 2	,,
,, C	·98676	,,	, 3	,,

while the mean of the whole set is

$$1\text{ ohm} = {\cdot}986307\,\frac{\text{earth quadrant}}{\text{second}},$$

this being determined from nine sets of observations. If we include Part I, giving to each observation only half the weight of one of those in Part II (reasons for this are given at full in the paper), we have finally

$$1\text{ ohm} = {\cdot}986271\,\frac{\text{earth quadrant}}{\text{second}}.$$

The value obtained by Lord Rayleigh in his latest experiments with the rotating coil is

$${\cdot}98651\,\frac{\text{earth quadrant}}{\text{second}}.$$

The experiments have been made at the Cavendish Laboratory, and our thanks are due to Lord Rayleigh for much kind help and many valuable suggestions.

IV. "On a Deep Sea Electrical Thermometer." By C. WILLIAM SIEMENS, D.C.L., F.R.S. Received June 7, 1882.

In the Bakerian Lecture for 1871, which I had the honour of delivering before the Royal Society,* I showed that the principle of the variation of the electrical resistance of a conductor with its temperature might be applied to the construction of a thermometer, which would be of use in cases where a mercurial thermometer is not available.

The instrument I described has since been largely used as a pyrometer for determining the temperatures of hot blasts and smelting

* "Proc. Roy. Soc.," vol. 19, p. 443.